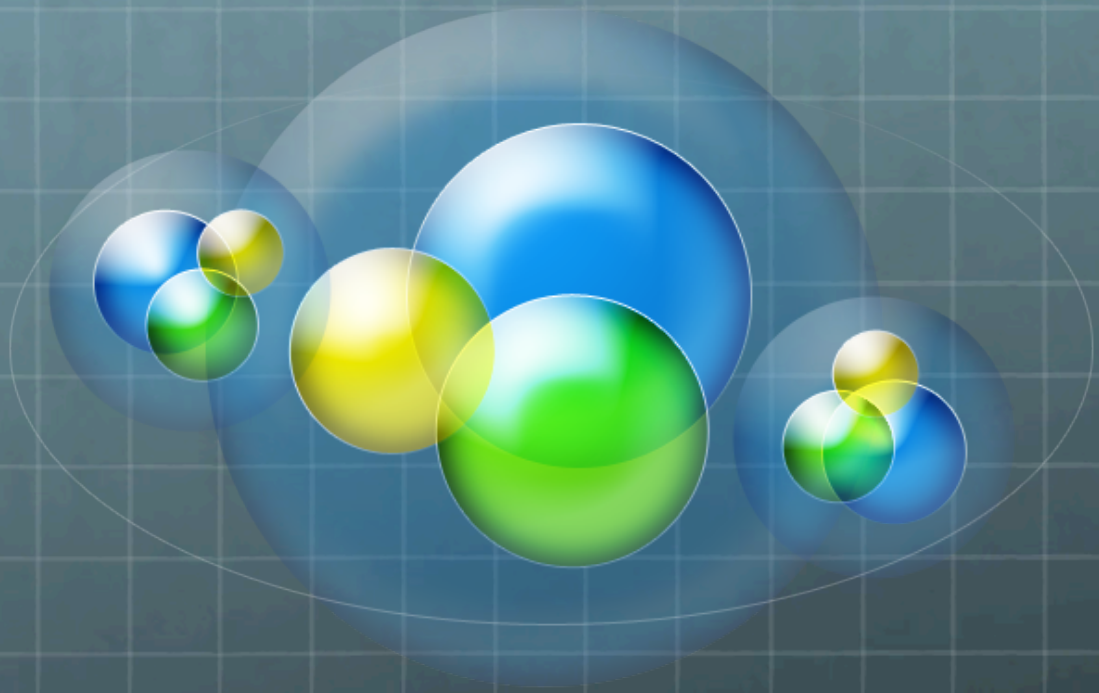
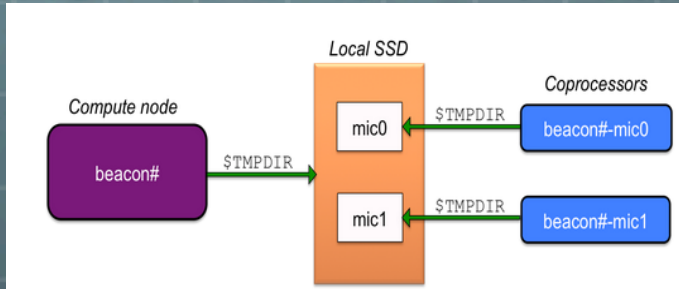


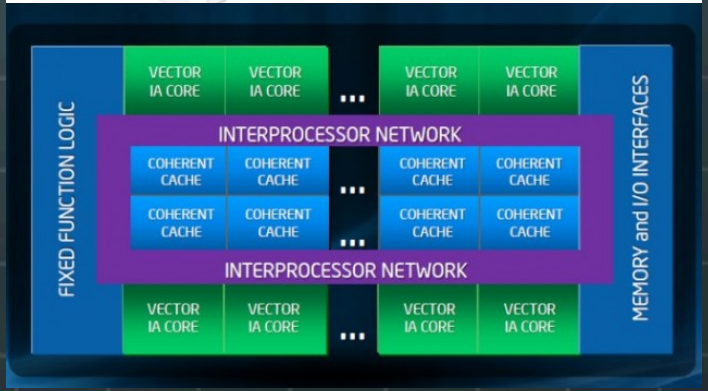
Runtime System and Out-of-Core Cholesky Factorization on the Intel Xeon Phi System

By Allan Richmond Morales and Tian Chong

Overview – Runtime System

- **Basic Specifications:**
  - Beacon: 157.3 TFLOPS (peak)
  - 672 processors and 42 active nodes in total
  - Four 1.054 GHz Intel Xeon Phi co-processors, each having 60 cores
  - Maximum Ideal Performance from co-processors: 4040 GFLOPS
- **Programming Environments:**
  - PLASMA – dense algebra algorithms
  - QUARK – multithreading and task management
  - Intel MKL Library – optimized math library for comparison with PLASMA
- **Purpose:**
  - Modifying the current OOC driver to implement QUARK threading and management in order to accomplish potential optimization
- **All performance testing will rely on Native Mode Execution**





Overview – Out of Core

[Title]

- [What is OOC algorithm]
- [How does it differ from standard Cholesky]
- What is the Task-Based DAG

Proposed Methodology

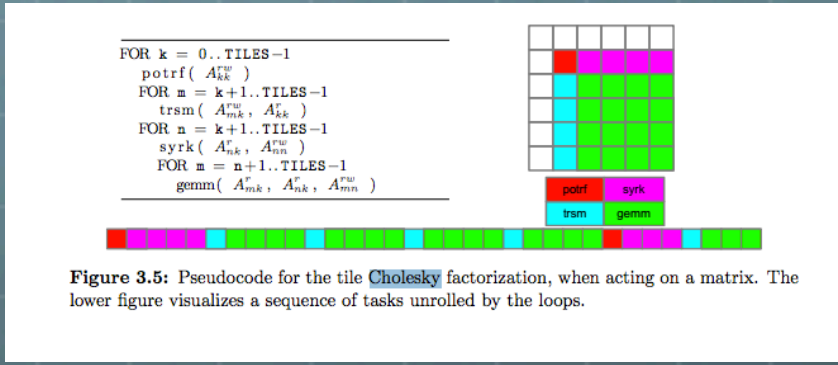
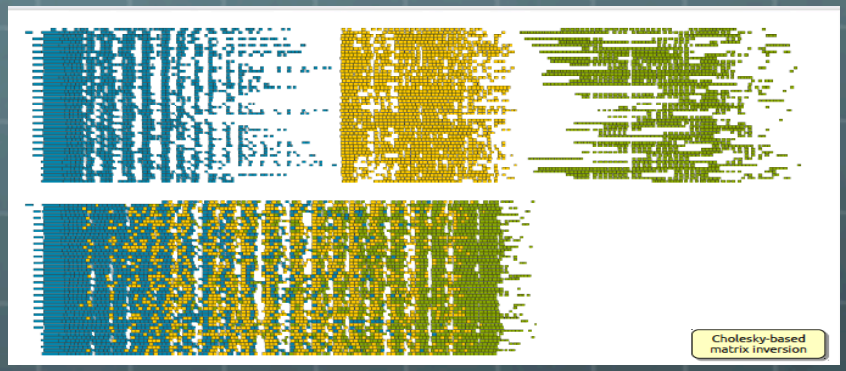


Figure 3.5: Pseudocode for the tile Cholesky factorization, when acting on a matrix. The lower figure visualizes a sequence of tasks unrolled by the loops.



- **Runtime Systems**
  - Understanding each programming environment
    - Matrix Multiplication & DGEMM (QUARK, PLASMA, Intel MKL)
    - Hello World Multithreading (QUARK, Intel MKL)
    - Performance Testing in seconds & GFLOPS (PLASMA, Intel MKL)
  - Interacting with Beacon
    - Bash Scripting Interactive Jobs, Native Mode Execution
  - End Goal
    - Optimizing the current runtime system using the current research Out of Core (OOC) Driver

- Out of Core Cholesky
- [What have you been reading?]
- [Any test code?]

- Task-Based DAG

References

- Betro, Vincent. *Beacon Quickstart Guide at AACE/NICS*
- Betro, Vincent. *Beacon Training: Using the Intel Many Integrate Core (MIC) Architecture: Native Mode and Intel MPI*. March 2013
- Dongarra, Jack, et al. *PLASMA Users' Guide Version 2.3*. Sept. 2010
- Kurzak, Jakub. PLASMA/QUARK and DPLASMA/PaRSEC tutorial: ICL UT Innovative Computing Laboratory.
- YarKhan, Asim, Jakub Kurzak, and Jack Dongarra. *QUARK Users' Guide*. April 2011